

CLAIMS

We claim:

*Sub B1*

1. A silsesquioxane polymer, useful for preparing  $\text{SiO}_2$ -rich films, which comprises the polymeric reaction product obtained from the hydrolysis and condensation polymerization of an organosilane containing a  $\beta$ -substituted alkyl group, the organosilane having the general formula:



where  $n$  is 1 or 2;

$X$  is a halogen selected from the group consisting of chlorine, bromine, fluorine, and iodine; or an alkoxy selected from the group consisting of methoxy, ethoxy and propoxy substituents; and

$R$  is an alkyl group having at least one but not more than two  $\beta$ -substituents that are electronegative; and wherein said polymeric reaction product contains silanol groups.

*siloxane*

2. The silsesquioxane polymer of claim 1 wherein, in the general formula for the organosilane,  $R$  is an ethyl group or propyl group having at least one but not more than two  $\beta$ -substituents selected from the group consisting of ~~chlorine~~, bromine, fluorine, iodine, hydroxy, methoxy, ethoxy, and acetoxy.

*siloxane*

3. The silsesquioxane polymer of claim 1 which further comprises at least one but not more than two

*Sub B1*

$\alpha$ -substituents on the  $\beta$ -substituted alkyl group, the  $\alpha$ -substituent being selected from the group consisting of chlorine, bromine, fluorine, iodine, hydroxy, methoxy, ethoxy, and acetoxy.

*Siloxane*

4. The ~~silsesquioxane~~ polymer of claim 3 wherein the  $\alpha$ -substituent is the same as the  $\beta$ -substituent on the alkyl group.

*Sub B2*

5. The ~~silsesquioxane~~ polymer of claim 1 wherein, in the general formula for the organosilane, n is 1;

X is a halogen selected from the group consisting of chlorine and bromine or an alkoxy selected from the group consisting of methoxy and ethoxy substituents; and

R is an ethyl group having at least one but not more than two  $\beta$ -substituents selected from the group consisting of ~~chlorine~~, bromine, fluorine, hydroxy, methoxy, and acetoxy.

*Siloxane*

6. The ~~silsesquioxane~~ polymer of claim 5 which further comprises at least one but not more than two  $\alpha$ -substituents on the  $\beta$ -substituted ethyl group, the  $\alpha$ -substituent being selected from the group consisting of chlorine, bromine, fluorine, hydroxy, methoxy, and acetoxy.

Siloxane

7. The silsesquioxane polymer of claim 6  
wherein the  $\alpha$ -substituent is the same as the  $\beta$ -substituent  
on the ethyl group.

Siloxane

Sub B3  
8. The silsesquioxane polymer of claim 1  
wherein the polymeric reaction product is obtained from  
the hydrolysis and condensation polymerization of  
a  $\beta$ -substituted ethyltrichlorosilane, wherein the  
 $\beta$ -substituent is non-halogenated.

Siloxane

9. The silsesquioxane polymer of claim 1  
wherein the polymeric reaction product contains at least  
about five up to about 75 silanol groups per 100 silicon  
atoms.

Siloxane

10. The silsesquioxane polymer of claim 1  
wherein the polymeric reaction product contains about 20  
to about 50 silanol groups per 100 silicon atoms.

Siloxane

11. The silsesquioxane polymer of claim 1  
wherein the polymeric reaction product is obtained from  
homopolymerization of the organosilane.

Siloxane

12. The silsesquioxane polymer of claim 1  
wherein the polymeric reaction product is obtained from  
copolymerization of the organosilane with an alkoxy silane.

Siloxane

13. The silsesquioxane polymer of claim 12  
wherein the alkoxy silane is selected from the group

consisting of tetraethoxysilane (TEOS), tetramethoxysilane (TMOS), methoxytriethoxysilane, triethoxychlorosilane, ~~bis(p-chloroethyl)dichlorosilane~~, ~~bis(trimethoxysilyl)-~~ ethane, methyltriethoxysilane, vinyltriethoxysilane, pentafluorophenyltriethoxysilane and tridecafluoroctyl-1H, 2H, 2H-octyltriethoxysilane.

Sub B4  
further

14. The ~~silsesquioxane~~ polymer of claim 1 which further comprises a polymeric reaction product obtained from copolymerization of the organosilane with a hydride-functional silane selected from the group consisting of trichlorosilane and triethoxysilane.

## siloxane

15. The ~~silsesquioxane~~ polymer of claim 1 which further comprises a polymeric reaction product obtained from copolymerization of the organosilane with an organotrichlorosilane selected from the group consisting of ethyltrichlorosilane, methyltrichlorosilane and phenyltrichlorosilane.

Sub B5  
where:

17. The ~~silsesquioxane~~ polymer of claim 16  
wherein the polymeric reaction product is extracted from  
the aqueous medium with an organic solvent.

siloxane

~~siloxane~~ 18. A homogeneous liquid containing the ~~silsesquioxane~~ polymer of claim 1 and an organic solvent for dissolving the silsesquioxane polymer, the solvent being selected from the group consisting of aromatic hydrocarbons and their epoxy-functional derivatives, glycol ethers, alkanes and their epoxy-functional derivatives, ketones, esters, orthoesters, chlorinated hydrocarbons, chlorofluorocarbons and alcohols.

19. The homogeneous liquid according to claim 18, wherein the organic solvent is selected from the group consisting of diglyme, methoxypropanol and toluene.

20. The homogeneous liquid according to claim 19, wherein the organic solvent is diglyme and the solubility of the siloxane polymer in the organic solvent is at least 15% by weight, based on the weight of the solution.

Add A1

Add B7

Add D1